

Research Article

Surgically Treated Severe Odontogenic Infections: A Large Cost to the United States Hospital System and Patients

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Abstract

Objectives

This purpose of this study was to analyze the cost of surgically treated severe odontogenic infections to both the patient and the hospital system.

Materials and Methods

This retrospective chart review assessed data of patient hospital charts surgically treated for severe odontogenic infections in the operating room and admitted for greater than one day. Hospital charts of consecutive inpatients admitted from the ED to the University of Texas Southwestern Medical Center and Parkland Memorial Hospital for treatment from January 1st 2016 to December 31st 2020, were reviewed. Patients with

infections of non-odontogenic origin were excluded. The specific outcome measures included total hospital stay cost, amount not collected, hospital charity adjustments, insurance type, length of stay, number of infected spaces, number of operating room visits, imaging ordered, and preadmission antibiotics.

Results

Data from 144 consecutive hospital charts were analyzed. The total billed cost of stay across all study years was \$6,888,326.52, the average billed cost per hospital stay was \$47,835.60, and the amount not collected was \$2,864,857.82. Of the total billed cost, \$2,107,692.15 was covered by hospital charity. Only

\$777,276.43 (11.3%) of the total \$6,888,326.52 billed was collected by the hospital.

Conclusions

Patients that are treated for severe odontogenic infections incur a large hospital bill that could have been avoided. Often, a very small percentage of this bill is collected by the hospital.

Keywords: Infection; Public health; Hospital dentistry; Cost

1. Introduction

Dental related emergency department (ED) visits account for about 4.3% of all ED visits in the United States annually, and a steady increase has been observed over time [1,2]. From 2001 to 2008 the national estimates for total ED visits for all conditions increased 13%, while the number of dental related ED visits increased more than 41% [3]. Patients present to the ED with a variety of dental conditions, the most common being dental caries [4]. Often, hospitals are not equipped to provide conservative dental treatment, and this leads to management with prescription antibiotics and analgesics instead of source control. It has been reported that 90% of dental related ED visits result in prescription medication instead of dental treatment [3].

Untreated dental caries may progress to severe odontogenic infections (SOI) with variable time and severity depending on several host and bacterial virulence factors. These SOIs, if left untreated, may lead to life threatening conditions such as airway embarrassment, mediastinitis, sepsis, cerebrospinal abscess, and cavernous sinus thrombosis [5]. Rarely, these infections can lead to death. The pathogenesis of SOIs usually begins with localized infection of the periapical region or vestibule, and when neglected, these infections follow the path of least resistance and spread to fascial spaces of the head and neck. In the

early phase of the disease process, patients typically have dental pain at which point conservative treatment may have prevented further progression. Consistent dental maintenance and procedures can be costly and may be a reason why many patients present to the ED with dental complaints. In cases when infections are severe enough to warrant admission and treatment in the OR, greater cost is incurred to the hospital system and the patients, which could have been prevented with routine maintenance and early conservative care. The purpose of this study was to analyze the cost of surgically treated SOIs to both the patient and the hospital system.

2. Materials and Methods

This retrospective chart review was designed to assess data of patient hospital charts admitted for SOIs and surgically treated in the operating room (OR). Institutional review board exemption was granted by the University of Texas Southwestern (UTSW). A database search of all patients treated in the operating room for odontogenic infections was completed. Severe odontogenic infections, as defined by this study, are those that involve fascial spaces of the head and neck requiring drainage in the operating room setting and admission for intravenous antibiotics. The decision to admit and treat in the OR was made by the attending surgeon based on clinical presentation, history, and laboratory results. Consecutive hospital charts were reviewed of inpatients admitted from the ED to the UTSW Medical Center and Parkland Memorial Hospital from January 1st 2016, to December 31st 2020. The inclusion criteria included patients surgically treated in the operating room for SOIs and admitted greater than one hospital day. Patients were excluded from the study if they had infections of non-odontogenic origin. The specific outcome measures included total hospital stay cost, amount not collected, hospital charity adjustments, insurance type, length of stay, number of infected

spaces, number of operating room visits, imaging ordered, and preadmission antibiotics. The amount not collected is the amount that was left unpaid by the patients after adjustments and designated in the financial record as a “bad account.” Demographic data was also collected.

3. Results

3.1 Demographics

This retrospective chart review consisted of 144 patient hospital charts that met the inclusion criteria. The median age was 40 years (range 16-81) with a male to female ratio of 5:4 (79:65). Table 1 provides a summary of demographic data as well as comorbidities.

Variable	n = 144	% of total n
Male	79	54.9
Female	65	45.1
Current smoker	53	36.8
Diabetic	33	22.9
HIV seropositive	9	6.3
Hematologic malignancy	2	1.4

Table 1: Demographics and comorbidities of all hospital charts reviewed.

3.2 Hospital stay characteristics

Each patient received at least one computed tomography (CT) scan during the hospital stay. The average number of spaces affected was 2.4 (range 1-8). The average length of stay was 5.1 days (range 2-46). Seven patients required advanced airway and intensive care unit stay following surgery for an average of 7.4 days (range 2-21).

3.3 Preadmission antibiotics

Data regarding antibiotic treatment prior to presentation to the ED was collected. Of the 144 patient charts reviewed, sixty-two (43.1%) had received antibiotics prior to presentation. Of the sixty-two patients, forty

(65%) received penicillin, eighteen (29%) received clindamycin, and four (6%) received other antibiotics or a combination.

3.4 Patient insurance characteristics

Residents of Dallas County are eligible for financial assistance based on income in relation to federal poverty income level guidelines and household size. Table II shows the insurance types of the study population. Patients with no income are eligible to receive free care and those with low income are eligible to receive care at a substantially reduced cost. Insurance type was categorized as self-pay, Medicare/Medicaid, charity, and private.

Insurance Type	n = 144	% of total n
Self-Pay	65	45.1
Medicare/Medicaid	24	16.7
Charity	33	22.9
Private	22	15.3

Table 2: Insurance types of all hospital charts reviewed.

3.5 Cost summary

The total billed cost of stay across all study years was \$6,888,326.52, the average billed cost per hospital stay was \$47,835.60, and the amount not collected was \$2,864,857.82. Of the total billed cost \$2,107,692.15 was covered by hospital charity. Insurance adjustments accounted for \$1,138,500.12 of the total billed. A total

of \$777,276.43 (11.3%) was collected by the hospital over the study period. Table III provides a cost summary for each year included in the study. The percentages of the total billed amounts that were collected by the hospital per year were: 17.1% (2016), 6.1% (2017), 14.2% (2018), 3.9% (2019), and 16.2% (2020).

Variable	2016	2017	2018	2019	2020
Total billed cost	\$966,527.82	\$1,503,482.69	\$1,408,722.98	\$1,343,745.78	\$1,665,847.25
Amount not collected	\$154,529.95	\$1,039,787.09	\$697,397.96	\$459,992.18	\$513,150.64
Hospital charity	\$271,762.42	\$288,579.88	\$245,335.32	\$656,338.56	\$645,675.97
Insurance Adjustments	\$375,019.71	\$84,155.91	\$265,762.10	\$176,054.51	\$237,507.89

Table 3: Cost summary for each year included in the study.

4. Discussion

The purpose of this study was to analyze the cost of surgically treated odontogenic infections to both the patient and the hospital system. Of the total \$6,888,326.52 billed across all study years, only \$777,276.43 was collected (11.3%). Few studies have investigated the cost of surgically treated odontogenic infections. In a study of forty-two patients with odontogenic infections treated surgically from 2005 to 2008, Jundt and Gutta reported a total of \$749,382 billed and \$70,123 (9.4%) collected [6]. Christensen and colleagues reported a total of \$5,422,854 billed and \$1,528,869 collected (28.2%) in a study of 318 patients from 2001 to 2011. This study included patients treated for odontogenic infections outside of the operating room (clinic, emergency, or combination of both) [7]. In a study by Ahmad and colleagues of 327 patients admitted for management of acute odontogenic infections from 2003 to 2010, more than \$10,000,000 was billed [8]. However, this study did not include the amount collected by the hospital. Previous studies have shown that many factors are significant predictors of increased hospital bills including location of treatment, length of stay, length of ICU stay, return trips to the OR,

and type of antibiotic regimen [7,9]. The average length of stay in our study was 5.1 days and the average length of ICU stay was 7.4 days. Ten patients required return trips to the OR, and an average of 2.4 fascial spaces were involved. These factors were similar to previous studies with the exception of ICU stay duration, the average of which is elevated due to a patient with bilateral deep neck abscesses who required tracheostomy and extended ICU stay [10-12]. The demographic characteristics of our study population were similar to previous studies, with the exception of higher tobacco use and prevalence of diabetes [13,14]. The average cost of stay billed to the patient by the hospital was \$47,835.60 which is comparable to findings of \$48,351 by Gams et al [15]. In our study population 45.1% of patients were categorized as self-pay. For an uninsured patient, a bill of this magnitude is a significant financial burden that could have largely been avoided with preventative care. The total cost of hospital management of odontogenic infections is not fully elucidated by this study, which is limited by its retrospective design. The total cost did not account for the cost incurred from follow up visits, treatment by incision and drainage in the ED, and ED visits for dental

pain that resulted in antibiotic treatment only. The total cost is certainly much higher with these components considered.

5. Conclusion

In conclusion, our study shows the substantial cost associated with admission and surgical treatment of SOIs. This cost is a heavy burden on the hospital system and patients. Surgical treatment of SOIs represents a significant loss of hospital revenue yearly. In patients with SOIs, it is paramount to minimize factors that are predictive of increased hospital bills. Given the preventable nature of these infections, this study highlights the importance of regular dental visits, good oral hygiene practices, and increased access to dental care in the United States.

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Conflict of interest

The authors have no conflict of interest to declare.

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